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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/658,732	09/11/2000	Makoto Inai	P/1071-1118	4527

7590 06/11/2003

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EXAMINER

BAUMEISTER, BRADLEY W

ART UNIT	PAPER NUMBER
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2815

DATE MAILED: 06/11/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.
09/658,732

Applicant(s)
Inai et al.

Examiner
B. William Baumeister

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Apr 7, 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 and 12-15 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 and 12-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____ 6) ☐ Other: _____

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DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1-10 and 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sawada et al., "A Super Low-Noise AlGaAs/InGaAs/GaAs DC-HFET with 0.15 micron Gate-Length" [Sawada] in view of Enoki, "Delay Time Analysis for 0.4- to 5-micron-Gate InAlAs-InGaAs HEMT's" [Enoki].

a. Sawada discloses a DC-HFET having a doped channel composed of n-InGaAs; a doped barrier (or semiconductor structure) composed of n-AlGaAs (a material having a lower electron-affinity than that of the channel); and a doped contact composed of n-GaAs. An ohmic electrode is formed on the GaAs contact layer and a Schottky electrode is formed on the barrier layer semiconductor structure. The doped AlGaAs barrier forms isotype heterojunctions with the InGaAs channel and the GaAs contact layers. Sawada does not anticipate the claims because it does not teach the further inclusion of an undoped layer/region disposed between the doped top and the bottom regions of the AlGaAs barrier layer, nor that the gate makes Schottky contact particularly to this undoped layer region (claim 14).

b. Enoki teaches III-As-based HEMT HFETs that comprise an n-InGaAs channel; an InAlAs "semiconductor structure" comprised successively of an n-doped, undoped, and n-doped

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layer; an n⁺ InGaAs contact layer for connection of ohmic electrodes; and a Schottky gate that contacts the middle, undoped layer of the “semiconductor structure.” (See e.g., FIG 1) Enoki specifically states that “the undoped InAlAs layer between two highly doped InAlAs layers is to enhance the Schottky barrier of the gate metal.” (Page 502, section II, col. 1)

c. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the Sawada n-AlGaAs barrier layer by providing an additional undoped layer between the top and bottom portions (or restated, by temporarily stopping and restarting the dopant supply during the growth of the barrier layer) for the purpose of enhancing the Schottky barrier of the gate as taught by Enoki.

d. Regarding claims 3, 5 and 7, while Sawada discloses a DC-HFET having a heavily doped channel, barrier and cap layer, wherein the respective junctions are all iso-type heterojunctions, Sawada does not teach the limitations of claim 3 which recites that the layers of the channel/barrier junction and the barrier/contact junction are all doped 1E18. Rather, Sawada--while also disclosing that these layers are all heavily doped to the same order of magnitude--sets forth specific, slightly higher doping concentrations for the channel, barrier and contact layers of 2.5E18, 1.5E18 and 3E18, respectively.

i. Nonetheless, it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the doping concentrations to the particular doping levels set forth in claim 3 because the doping levels of the Sawada layers are all heavily doped to the same order of magnitude as that claimed, and such minor changes to the doping levels would

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not produce any unexpected results, but rather constitute an optimization of results readily obtainable through routine experimentation: more specifically, lowering the barrier doping concentration from 1.5E18 to 1E18 would merely produce the expected results of proportionally increasing the gate-barrier layer Schottky barrier and slightly increasing the source/drain resistance; decreasing the channel doping from 3E18 to 1E18 would slightly reduce both the channel/barrier heterojunction barrier and the carrier-impurity scattering in the channel; and reducing the contact doping from 3E18 to 1E18 would proportionally increase the source and drain resistances.

Double Patenting

3. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground

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provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

4. Claims 1-10 and 12-15 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-10 of copending Application No. 09/659,134. Although the conflicting claims are not identical, they are not patentably distinct from each other because the claims of both applications are directed towards HFETs having a 3-layer doped-undoped-doped barrier structure having a lower electron affinity than the underlying doped channel. The only substantive difference between the applications is that the present claims are arguably narrower than those of the '134 application because the latter application does not expressly recite that the two doped layers form isotype heterojunctions with the adjacent channel and contact layers. Nonetheless, it would have been obvious to one of ordinary skill in the art at the time of the invention that the respective doped layers of the '134 application would all be doped the same conductivity type (e.g., n-type) so as to prevent the existence of parasitic p-n junction diode action and so that the HFET would operate as intended.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

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Response to Arguments

5. Applicant's arguments filed 10/25/2002 have been fully considered but they are moot in light of the new grounds of rejection.

Conclusion

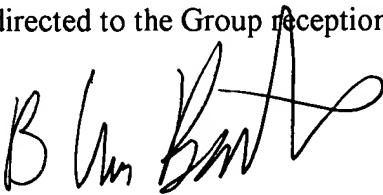
6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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INFORMATION ON HOW TO CONTACT THE USPTO

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister**, at **(703) 306-9165**. The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Eddie Lee, can be reached at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

A handwritten signature in black ink, appearing to read 'B. William Baumeister', with a stylized, cursive script.

B. William Baumeister

Patent Examiner, Art Unit 2815

June 7, 2003